

Prepared for the future

SMARTER SOLUTIONS FOR
PREPARED FOOD PRODUCTION



Prepare to win the food fight



We believe that your optimal solution is one that matches your specific production needs today and for the future – to make you more innovative, more effective and more competitive. And we believe that this optimal solution is born in applying our vast knowledge and complete range of innovative technology for food production in a close partnership with you.

Leading process development knowledge, extensive food production experience worldwide, exceptional engineering skills – it's from this starting point that we work with you to create production solutions that maximize your operational efficiency, your product versatility and your product quality while ensuring uncompromising food safety and environmentally sound production.

With our smart automation solutions, unique lifecycle perspective and customized services we also ensure maximum performance and profit throughout the lifecycle of your operation. And we offer you competitive and validated performance guarantees on the parameters that matter to your success and we stay until it works. Discover your optimal solution and prepare to win the food fight.



Optimal solutions for every need



Expertise in prepared food



Being prepared for the future means being tuned in to the growing demands of consumers for greater variety, higher quality and more – and staying one step ahead of the competition in meeting them. Our broad food application expertise and technology leadership equips you to do just that.

Consumers are looking for a greater variety of safe, high quality products to choose from that taste home-made, with quality particles and nutritional value, while reducing sugar, fat and additives. They're also demanding greater convenience in preparation and eating on the go and are increasingly favouring products that prioritize low environmental impact. Our broad and unrivalled food production expertise works

for you across the board – to innovate and optimize solutions to meet these growing demands and turn the challenges they pose into opportunities. We design your optimal solution to bring you higher value and lower impact. We do this by maximizing raw material utilization, minimizing water and energy consumption and reducing product losses and effluent load.

TECHNOLOGICAL LEADERSHIP ACROSS THE BOARD

- Mixing, blending and formulation
- Heat treatment
- Evaporation, spray drying and powder handling

SERVING UP FOOD APPLICATION EXPERTISE

- Batch and continuous production
- Smooth and particulate products
- Low to high viscosities
- Wet and dry products
- Ambient, chilled and frozen products



"Cost-effective product trials and in-house tests"



UNLEASH YOUR INNOVATION IN PRODUCT DEVELOPMENT CENTRES

- Ten PDCs worldwide at your service
- Highly flexible industrial pilot-plant facilities
- Cost-effective product trials and in-house tests
- Experienced food technologists and engineers
- Processing, packaging and powder handling equipment
- Global experience and application expertise
- Close collaboration, full confidentiality

Enabling future-proof production solutions

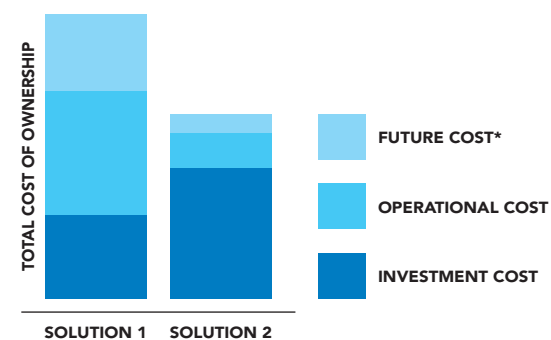
We customize your production solution to match your specific needs through a deep understanding of your production priorities and level of complexity. In other words, we optimize based on your big picture and the result is a solution that minimizes your total cost of ownership and gives you room to grow.

We apply our technology know-how and experience with an understanding of your needs to create solutions that:

- Meet your investment levels and profitability needs
- Meet requested functionality
- Draw upon reusable key units and design elements
- Are based on best engineering practice
- Deliver validated performance

Your optimal solution also gives you extensive flexibility, whether upgrading to respond to changing production complexity or with our automation solutions for total control and top performance to meet your specific needs.

MINIMIZING TOTAL COST OF OWNERSHIP



*cost of upgrading or expanding if equipment was not designed for it



Best-practice lines based on proven units

Based on a deep understanding of your production priorities, in terms of investment cost, production complexity, operational efficiency and more, we create the right solution to match your specific needs. We apply our best-practice lines to your applications and customize the solution to find the balance that is right for you.



BATCH LINE
For batch production of smooth and small particulate fruit and tomato preparations, desserts, soups and sauces.



BATCH PARTICULATE LINE
For batch production of smooth to particulate fruit preparations, soups and tomato preparations.



CONTINUOUS LINE
For continuous production of smooth to small particulate soups, sauces, desserts, baby food purées, fruit and tomato preparations.



CONTINUOUS PARTICULATE LINE
For continuous production of soups, sauces, baby food purées and tomato preparations with particles.



CONTINUOUS SMOOTH LINE
For continuous production of smooth soups, sauces and desserts.



CONTINUOUS RICE AND DESSERTS LINE
For continuous production of particulate rice desserts and fruit preparations.



CONTINUOUS HIGH-VISCOUS LINE
For production of high viscous desserts, soups, sauces, baby food purées, fruit and tomato preparations.



CONTINUOUS INSTANT AND DEHYDRATED LINE
For production of instant and dehydrated soups, sauces and bouillons/stocks.



CONTINUOUS POWDERED INFANT FORMULA LINE
For production of powdered infant formula from liquid or powdered milk.



CONTINUOUS READY-TO-DRINK INFANT FORMULA LINE
For continuous production of ready-to-drink infant formula.

PERFORMANCE GUARANTEES ON PARAMETERS THAT MAKE A DIFFERENCE

Guarantees on commissioning and performance criteria based on your production scenario and pre-defined in a contractual agreement include, for example:

- Steam consumption
- Particle integrity
- Capacity stability
- Product losses
- Production time

Mixing, blending & formulation

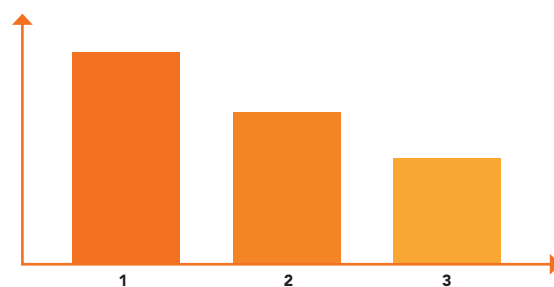
Technology leadership

Our extensive technology range covers low to high-shear mixing, and blending with varied levels efficiency and gentleness – all to ensure optimal dissolving, emulsifying and dispersing of powder and liquid ingredients into homogenous products with high particle integrity, consistent quality and even particle distribution. And our food technologists support you in formulation and process selection, for optimal recipe management to achieve your desired end results.

Efficient mixing for infant formula

An infant formula premix can consist of up to 70 ingredients, which puts high demands on dosing accuracy. Our advanced mixing technology ensures the efficient mixing and even distribution of these costly ingredients. Adding the ingredients under vacuum, and below the liquid surface in the tank, prevents air entrapment, which ensures efficiency and protects quality and safety. Our powerful mixer also enables you to produce infant formula premix with higher dry matter/total solids. When working with higher total solids and higher viscosity, this can increase your production and cost-efficiency by making it much faster to spray dry your product or even enable you to skip evaporation altogether. Faster mixing also reduces product time at mixing temperature, thus minimizing heat load during mixing to preserve nutrients, colour and taste.

AIR IN THE PRODUCT, VOLUME INDEX



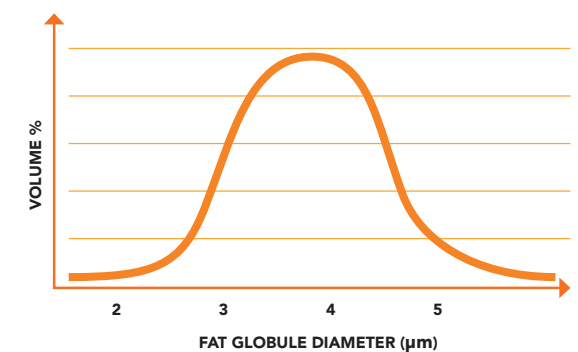
REDUCED AIR INCORPORATION WITH VACUUM MIXERS

1. High speed blender, such as a pump and a powder hopper with venturi nozzle.
2. High shear mixer with a rotor and stator technique.
3. High shear mixer with a rotor and stator technique combined with a vacuum.

Stable mayonnaise emulsions

Our technology enables physical stability and colour stability in emulsions such as mayonnaise and dressings. Our mixer achieves the right fat globule size, <5µm, to ensure stability and handles both high and low-shear mixing, which allows the addition of smaller particles in the same unit. This enables you to produce a wider range of recipes/products in the same machine, including dressings with herbs and/or vegetable particles and mayonnaise-based dressings with small vegetable and fruit particles.

FAT GLOBULE SIZE DISTRIBUTION



Behaviors and prevention of separation in dispersions (emulsion, suspension, gel).

According to Stoke's law, food processors may improve suspension stability by:

1. Decreasing the difference in density between the particles and the surrounding solution
2. Reducing particle size
3. Increasing the viscosity of the surrounding solution

The settling velocity (v) is influenced by the particle diameter (d), the particle density (ρ_p), the density of the solution (ρ_f) and the viscosity of the solutions (η); (g) describes the acceleration due to gravity.

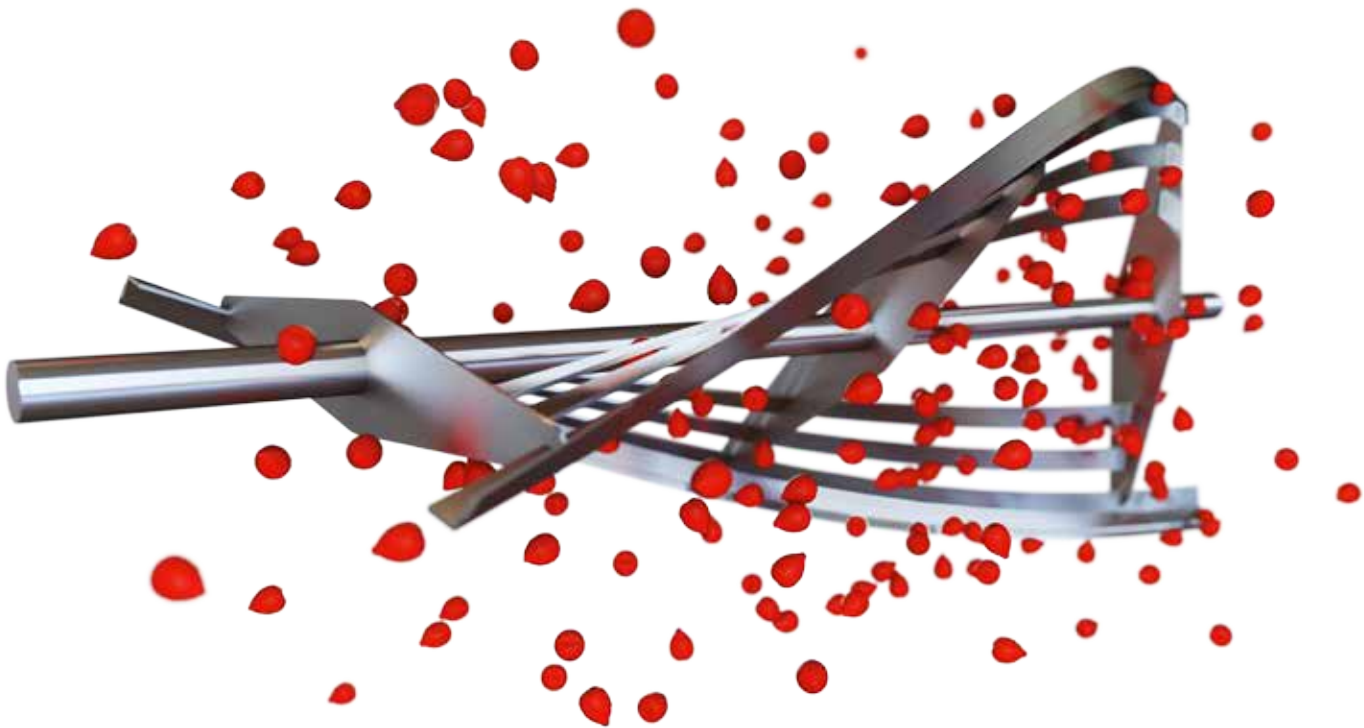
$$v = \frac{d^2 (\rho_p - \rho_f)}{18\eta} g$$



Gentle handling for fruit preparations with homemade quality

Our low-shear blending and processing equipment enables you to meet consumer demands for homemade taste, fresh colour, fewer additives and gentle handling of sensitive fruit pieces and berries. Even particle distribution ensures consistent quality, and your product is kept under hygienic conditions in one single piece of equipment throughout the entire process. Vacuum treatment speeds sugar penetration, which secures a stronger berry. Our equipment enables better flavour and even distribution of berries in a package.

SLOW-REVOLVING HELIX-SHAPED HORIZONTAL AGITATOR IS A BEST-PRACTICE SOLUTION FOR GENTLE BLENDING



The particle integrity in a food product is defined as the difference between the weight fraction of particles before and after processing and is expressed as weight percentage.

$$Part\ int = 1 - \frac{mPin - mPout}{mPin} \times 100\%$$

mPin: Particle weight percentage before process
mPout: Particle weight percentage after process

Heat treatment

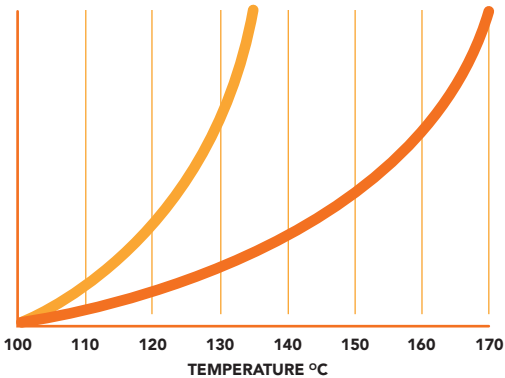
Technology leadership

Our wide range of heating technologies enables us to create the optimal solution for each product and production scenario. Your heat treatment solution is customized based on product composition, packaging, distribution and desired shelf life while always ensuring uncompromising food safety and efficient processing. Our technology leadership and expertise supports you to optimize heat load, in order to minimize chemical changes, and thus achieve desired shelf life while preserving taste, texture, colour and nutrients for all different kinds of products from rice desserts to smooth chocolate puddings or goulash soup.

OPTIMIZED HEAT LOAD MINIMIZES CHEMICAL CHANGES

Our heat treatment solutions meet new trends in consumer demands for greater

- Food safety
- Nutritional content
- Fresh homemade taste
- Consumer convenience
- Environmental benefits



■ SPORE DESTRUCTION ■ CHEMICAL CHANGES

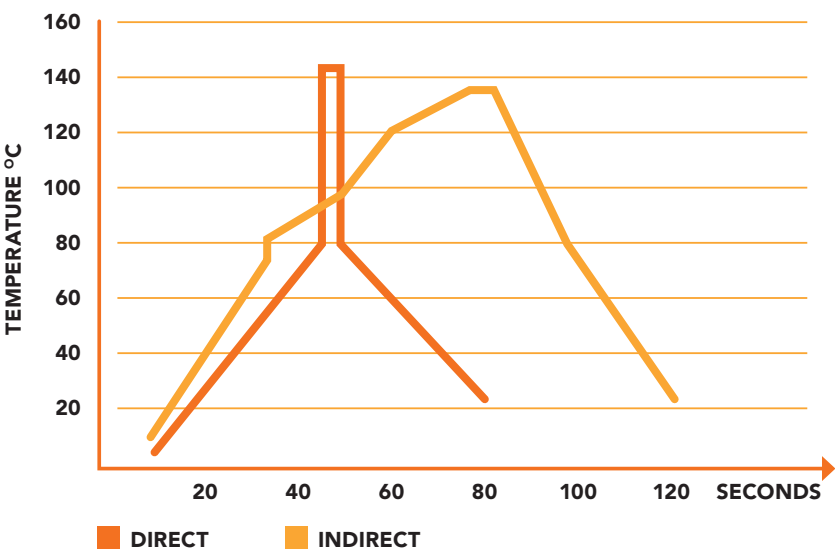
This graph illustrates how the bacteriological killing effect increases considerably at temperatures over 110°C, whereas chemical changes remain mild. By using a high temperature/short time heating process, you keep nutritional value high and taste deterioration low while always ensuring food safety.

Established food safety in infant formula powder

One key challenge in infant formula production is to meet growing demands on food safety and quality control. This requires increasing the temperature of the main heat treatment to reduce bacteria content in the final powder. We enable you to overcome this challenge with direct steam technology that is optimized to achieve desired food safety while preserving nutritional value. Traditional infant formula heat treatment eliminates vegetative bacteria, but has no effect

on bacterial spores. By applying UHT treatment at up to 140°C for a few seconds, bacterial spores such as Bacillus Cereus and Sulfide-reduced Clostridium are reduced by over 12 log, while thermophilic spores, which are much more difficult to eliminate, are reduced by at least 2 log. We calculate optimal time and temperature based on the target organisms and desired log reduction for spores or bacteria, and we design your equipment accordingly.

TEMPERATURE CURVE FOR DIRECT HEATING VERSUS INDIRECT HEATING



BACTERIA ELIMINATION AS LOG REDUCTION

Heat treatment	Enterobacter Sakazakii	Bacillus Cereus	Clostridium Botulinum	Bacillus Stearothermophilus
115°C, 6 sec*	> 10,000	0	0	0
140°C, 2 sec**	>10,000	40	12	2

* Traditional infant formula heat treatment

** Ultra high temperature heat treatment

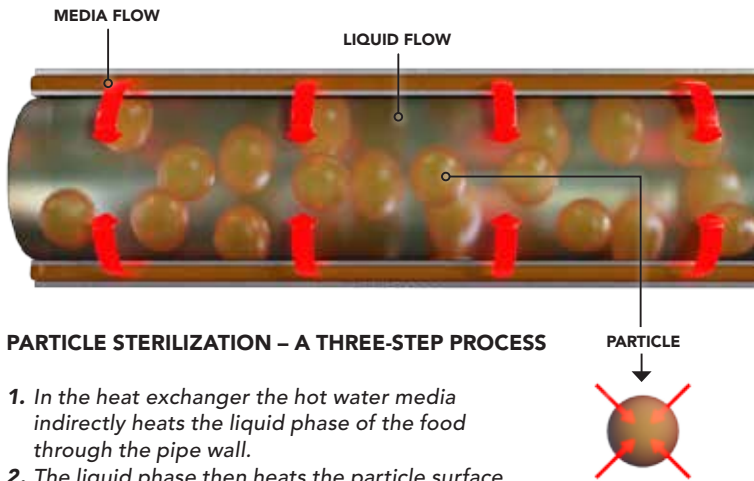
Delicious and safe particles in particulate foods

The key heat treatment challenge when producing particulate foods is to achieve a safe product by ensuring that particles reach required temperature in the coldest spot, i.e., the thermal centre of the particle, while simultaneously avoiding overcooking the liquid and surface of the particle to preserve taste, colour, texture and nutrients.

Our technology leadership enables you to meet this challenge by selecting the right heat exchanger with optimized heat exchanger design, whether it be a coil formed monotube for larger particles or a multitube for smaller particles. This gives you control of retention time to ensure optimal heat treatment with an optimized temperature curve. In a dual-stream process solution, heating is tailored even further to ensure the optimal quality of liquid and optimal food safety of particles.

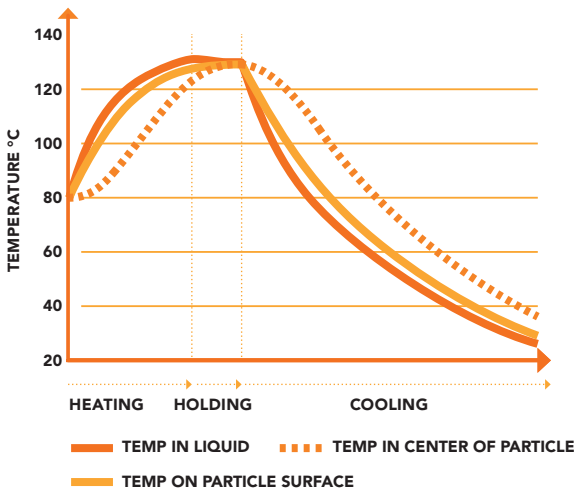
SCHEMATIC EXAMPLE OF HEATING A PARTICULATE PRODUCT

Heating of the centre of the particle is clearly delayed and the centre does not reach sterilization temperature until it reaches the end of the holding tube. With our calculation tools we design optimal heating solutions for particulate foods that take this phenomenon into consideration.



PARTICLE STERILIZATION – A THREE-STEP PROCESS

1. In the heat exchanger the hot water media indirectly heats the liquid phase of the food through the pipe wall.
2. The liquid phase then heats the particle surface.
3. Finally, the particle is heated by conduction of the heat from the surface into the centre of the particle.



Flexibility to produce a wide variety of baby food purées

A production line for baby food purées needs to handle a wide variety of different products such as low to high acid, smooth to particulate, and low to high viscous products, so that you can meet consumer demand for a wider range of baby food purées to choose from. This, in addition to a wide range of package formats, puts demands on production flexibility. Within one heating solution, you can pasteurize high-acid products such as fruit purées at 95°C, process low-acid products, such as meat and vegetable purees and dairy desserts, aseptically with heat treatment at 135°C and optimally treat purées with particles.



Evaporation, spray drying & powder handling

Technology leadership

Our technology enables gentle transport of powder and accurate, consistent dosing for optimal powder mixing and dosing. We also enable efficient water removal for optimal evaporation and flexible spray drying to handle a wide range of recipes and achieve the right final powder properties in each product.

Accurate, gentle production for consistent quality in dehydrated soups, sauces and bouillon cubes

We enable you to achieve consistent quality in producing dehydrated soups, sauces and bouillon cubes through accurate and consistent dosing and gentle transport systems to minimize separation of ingredients. In dry blending, we enable you to achieve consistent and accurate dosing of major and minor ingredients with accurate loss-in-weight feeders and create

a homogenous mix with our efficient paddle mixer. Powder particles such as vegetables and herbs have varying weights and sizes, and our efficient pneumatic conveying solution, with slow dense-phase conveying that avoids separation of powders and maintains the homogenous mix during transport.



Gentle and precise production for infant formula

The key challenge in the production of infant formula is to create the right powder specifications and to minimize powder breakdown with a gentle transport system to secure product quality. It is also vital to precisely control solubility index, wettability and bulk density.



EVAPORATION

The superior hygienic design of our evaporators, combined with minimized heat load and residence time/holding time enables efficient water removal and long running times. The high energy efficiency of the system comes in part from being customized, for example with steam or electricity used for final concentration, to ensure the optimal process solution while minimizing your energy costs.

PRE-CONCENTRATION

WATER REMOVAL	10 [T/h]	10 [T/h]
ELECTRICITY	160 [kWh]	-
STEAM	-	2 [T/h]
INVESTMENT	1.6 MEUR	1.5 MEUR
ECONOMICS	VERY GOOD	GOOD

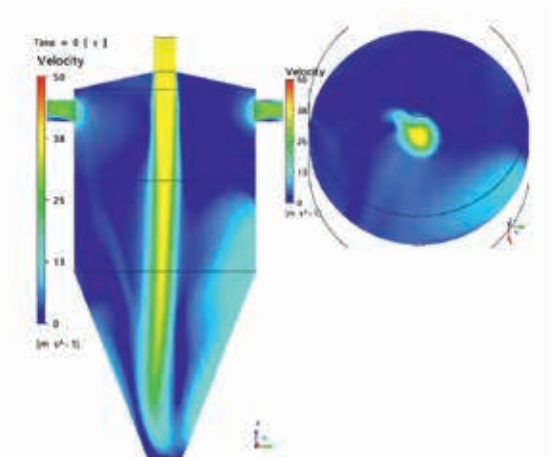
MECHANICAL VAPOUR RECOMPRESSION

3-STAGE THERMAL VAPOUR RECOMPRESSION

SPRAY DRYING

Our solution for spray drying ensures a precise, controlled process for removing final water content and producing the right powder quality, with high efficiency, long running times and low product losses. Our spray dryers enable you to handle a wide range of recipes for ultimate production flexibility. We customize the design of the spray dryer itself and offer flexible components in equipment and process settings to handle each unique recipe optimally. For example, we customize nozzle position and atomization pressure, and air temperatures to ensure precise final product properties. In addition, the powder fluidizers in our equipment ensure highly efficient water removal and optimal cooling of powder. Further, highly efficient cyclones for dust removal minimize powder emissions and the geometric design of the spray dryer prevents fouling and extends running time without cleaning by weeks. Our components have been designed with the aid of computational fluid dynamics.

COMPUTATIONAL FLUID DYNAMICS ON SPRAY DRYING PROCESS

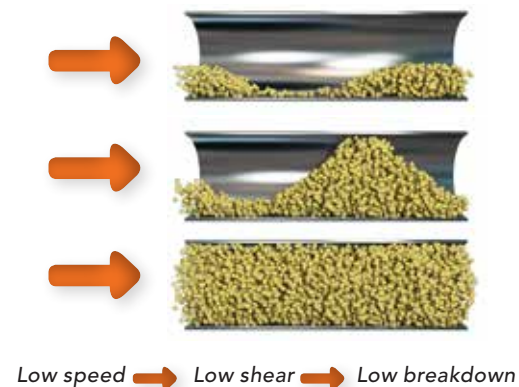


Case: simulated air velocity profile inside the drying chamber

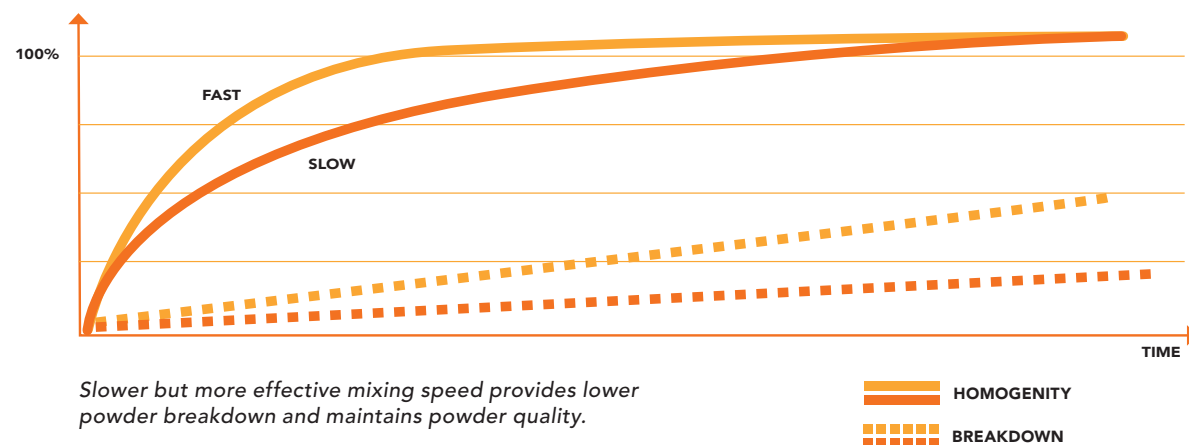
PRE AND FINAL POWDER HANDLING

When producing infant formula, we first select the right pneumatic conveying technology to meet your product needs. Pre-powder handling with our technology achieves fast, accurate and consistent dosing of ingredients into the wet mixes. In final powder handling the process solution we select minimizes break-down of powder and enables gentle dry blending that results in homogenous distribution, thanks to a gentle conveying and an effective paddle mixer with the right rotational speed. Accurate dosing of sensitive ingredients ensures safe food for infants and achieves an end product that dissolves easily and rapidly and has the right bulk density, i.e. bulk volume in the can and nutritional value at the spoon. The right properties ensure that consumers feel confident in the consistency and quality of the product.

BUILDING UP THE PLUG IN A DENSE-PHASE TRANSPORT SYSTEM TO ENABLE GENTLE CONVEYING OF POWDER

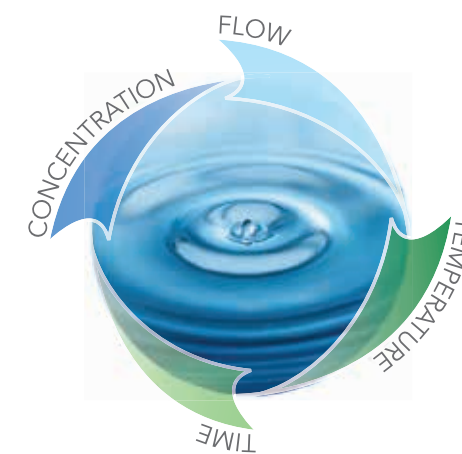


PREVENTING BREAKDOWN IN DRY BLENDING OF POWDERS



Overcoming hygiene challenges with smart CIP safety

Thanks to smart automation, our CIP (cleaning in place) unit optimizes the right temperature, amount of water flow, detergent concentration and time to achieve uncompromising food safety. It achieves this while cutting the consumption of water by 21% and chemicals by 6%, and delivering unique flexibility to meet every CIP need – all at the lowest operational cost.



It doesn't end at equipment delivery

Our smart automation solutions give you complete control of your production and customized services ensure maximum performance and profit throughout the lifecycle of your operation. We also offer you competitive and validated performance guarantees on the parameters that matter to your success.

Our smart automation solutions enable complete control and top performance with maximum efficiency, future-proof flexibility and full traceability – while cutting human error to a minimum and streamlining your entire operation.

Our unique lifecycle perspective and customized services maximize your operational excellence, minimize your cost and environmental impact, and ensure the right product quality every time, throughout the lifecycle of your operation.



Your optimal solution is your competitive edge

Your optimal solution makes you more innovative, more effective and more competitive. And we believe that this optimal solution is born in applying our vast knowledge and complete range of innovative technology for food production in a close partnership with you. Prepare to win the food fight.



Exceptional performance – we guarantee it

Our competitive and validated performance guarantees on the parameters that matter to your success, ensure exceptional performance in terms of consistent product quality, uncompromising food safety, maximized product versatility, optimized production flexibility and efficiency, with minimal environmental impact for long-term sustainable growth. The parameters are predefined in a contractual agreement and guarantee that we're with you all the way – we stay until it works.